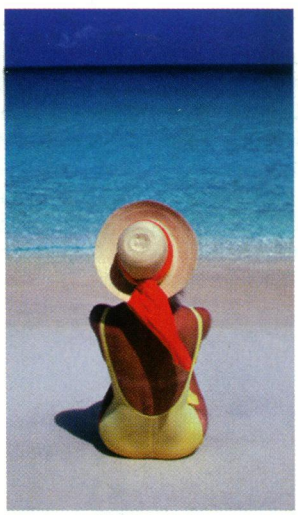
determined. The treaty signers will meet later this year to discuss this and other problems that have already surfaced. One such problem is that there is considerable scientific uncertainty as to how, or if, many species can even be saved. Another problem is how to balance access to genetic material with biotechnology profits. The treaty signers also face questions about how the treaty will be financed, how the technology will be shared, and how the permanent secretariat will be established.

The treaty became legally binding after the 30th signer, Mongolia, ratified it. Among the other countries that have ratified the treaty are industrialized nations such as Canada, Japan, Norway, and Australia, and a number of developing countries such as Uganda, Nepal, the Philippines, and Ecuador. "I think its worth remarking that the first 30 ratifications came overwhelmingly from the lower-income countries," Angela Cropper of Trinidad and Tobago, executive secretary of the treaty's interim secretariat, told the *The New York Times.* "Biological diversity—our food and medicines as well as the treasure house of animals and plants—come mainly from the tropical and developing nations. If we want to continue to profit from this wealth, we must make it worthwhile for poor countries to protect this heritage," she said.

No Fun in the Sun

Sunbathers who believe using sunscreens or tanning at indoor salons make tanning safe may soon see a dark cloud on the horizon. In the past, some scientists assured the public that the use of sunscreen would help prevent skin cancers, including melanoma, the deadliest form of skin cancer. It has also been generally accepted that the use of UV-A light in tanning salons is a safe alternative to the shorter wavelength UV-B, which was thought to induce melanoma. But recent studies on how ultraviolet light affects the skin challenge these theories.



What's in a name? Sunscreens may not really screen out the most harmful effects of tanning.

A study by Peter Wolf and colleagues at the M. D. Anderson Cancer Center in Houston found that while sunscreen did protect mice from sunburn when they were exposed to ultraviolet light, it did not protect them from developing melanomas. Because sunscreen has been proven to help prevent the development of some forms of skin cancer, the researchers had expected sunscreen to protect against developing melanomas also.

The three sunscreens used in the study contained FDA category I sunscreens with the maximum approved concentration of the single compounds being tested by the researchers. Two of the three were UV-B-absorbing sunscreen preparations with an anti-inflammatory sun protection factor (SPF) of at least eight in mice. The third sunscreen preparation was a UV-A and UV-B absorber with an SPF of at least four. The researchers applied the sunscreens to the ears of mice and then injected them with melanoma cells. When they exposed the mice to ultraviolet light, the melanoma cells grew more aggressively than usual. They also observed that ultraviolet light suppressed the immune system of the mice. "What we found was that the exposure of skin to ultraviolet light will result in a change in the immunological environment," said Cherrie E. Donawho, one of the researchers. The breakdown of the immune system may be a factor in the development of melanomas. Even when sunscreen was applied and no noticeable damage was done to the skin by the ultraviolet light, the immune system was still suppressed. This suggests that even when the skin does not burn, there may be changes below the surface.

According to the researchers, the use of sunscreen may actually contribute to the risk of developing melanomas because protection against sunburn may encourage prolonged exposure to the sun. If melanomas are a result of exposure to ultraviolet light, rather than a result of sunburn, the longer periods of sun exposure may increase the risk of melanoma.

Beliefs about the "safe" light currently used in tanning salons may also be incorrect. In the past, UV-A light has been considered safer than shorter wavelength UV-B because it is not as readily absorbed by DNA and is therefore less likely to damage it. However, recently published research suggests that direct damage to DNA is not the only cancer-causing event caused by UV light, and UV-A light is not as safe as previously thought.

Richard B. Setlow led a study at the Brookhaven National Laboratory on the effect of different wavelengths of light on pigmented hybrid fish that are very sensitive to melanoma. He found that the group of fish exposed to UV-A light developed the same number of melanomas as the group of fish exposed to UV-B light. This suggests that wavelengths of light not directly absorbed by DNA still contribute to the development of melanoma. Setlow believes that the skin pigment melanin absorbs the radiation in UV-A and in turn affects DNA by energy or free radical transfer, thereby inducing melanoma.

The fish used in the experiment are bred to be extremely sensitive to melanoma, more sensitive than even fair-skinned humans, Setlow said. Darker-skinned people do not develop as many melanomas as fairer-skinned people. But he believes the fish can serve as a good model for the effects of UV light on humans. "The sensitivity of the fish versus humans is not important. What is important is the relative effect of wavelengths on the pigment cells," he said.

Setlow's advice to reduce chances of developing melanoma is to slowly tan, rather than expose skin to the sun in fewer, longer episodes. "To go out into the sun and get an episode of lots of light is probably bad," he said.

New R&D Directions

On March 28, a meeting was convened in Washington, DC, to set in motion the Clinton administration's plans for revamping federal scientific research and development. The National Forum on Environment and Natural Resources Research and Development assembled representatives of the scientific community, the private sector, Congress, state and local governments, and nongovernmental organizations to provide their insights to the members of the agencies represented on the Committee on Environment and Natural Resources Research (CENR) of the National Science and Technology Council (NSTC).

The NSTC, chaired by the president, was created by Executive Order 12881 on 23 November 1993 as a cabinet-level body to coordinate science, space, and technology policies throughout the government. Said President Clinton in announcing the NSTC, "Science and technology are essential tools for achieving the administration's goals for strengthening the economy, creating high-quality jobs, protecting the environment, improving our health care and education systems, and maintaining our national security."

The forum, sponsored by the White House Office of Science and Technology Policy, the National Academy of Sciences, and the National Academy of Engineering, in addition to the NSTC, was the first in a series of planning efforts to develop a long-term strategy for the nation's R&D programs. Before the meeting, the agencies of

the CENR prepared preliminary strategies for establishing scientific approaches and short-term priorities for seven programmatic and three cross-cutting issue areas in which to address the administration's concerns about federal R&D efforts. The programmatic issues include air quality, biodiversity and ecosystems, global change, natural disasters, resource use and management, toxic substances and hazardous and solid waste, and water resources, coastal, and marine environmental research. The three cross-cutting issues are risk assessment, social and economic sciences, and technology and engineering.

The areas outlined in the preliminary strategic plans will provide the structure for addressing key weaknesses in federal R&D that have been raised in a number of reports over the last two years, including program integration, interagency cooperation, links to the policy formulation process, partnerships with industry and academia, research approaches that address long-term scientific issues as well as short-term management and regulatory requirements, need for expanded federal efforts in the biological and social sciences, and human resource development.

Some of the key administration officials who took part in the forum are John Gibbons, assistant to the president for science and technology; Vice President Al Gore; Secretary of Interior Bruce Babbitt; Robert T. Watson, associate director for environment of OSTP; D. James Baker, under secretary for oceans and atmosphere of the Department of Commerce; EPA Administrator Carol Browner; and Kathleen McGinty, director of the White House Office of Environmental Policy. Interagency cooperation, sustainable development, and effective integration of science and policy were major themes throughout the addresses given during the forum.

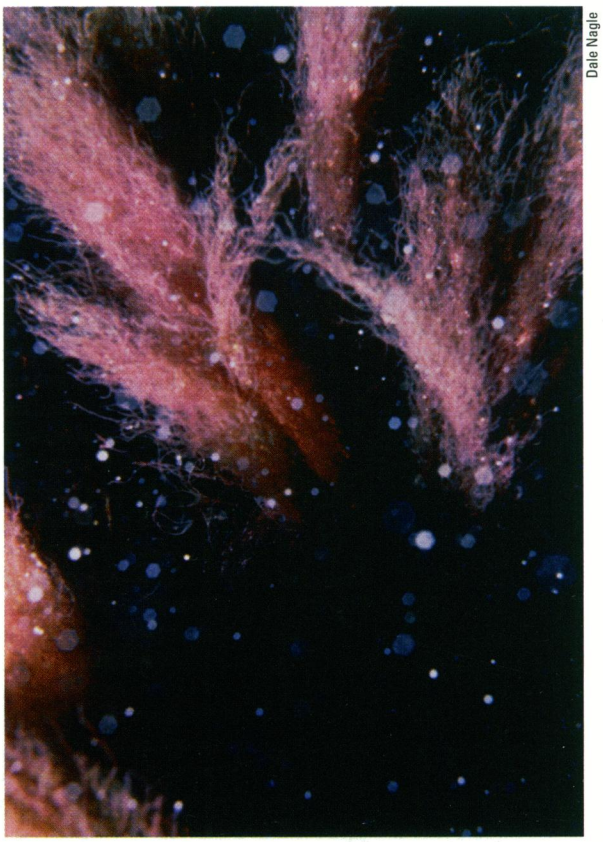
Browner offered three suggestions to guide the federal research agenda. First, move away from basing regulations on risks to the average person to protecting those populations who are most at risk, including children, minorities, pregnant women, and the elderly. Second, use an ecosystem approach that recognizes the integration of natural resources; for example, air pollution in water that is eventually consumed by animals and humans. Finally, incorporate industrial incentives for preventing pollution and reducing consumption, rather than devoting increasing resources to the development of better waste disposal technologies.

At the forum, strategic plans in each of the 10 areas were reviewed and finalized. These documents will form the rationale for selecting high-priority research areas for inclusion in budget requests for fiscal year 1996.

Underwater Drugstore

Always in search of new disease-fighting substances, scientists are now diving into the ocean for new possibilities. According to scientists, the world's oceans are more genetically diverse than tropical rain forests and may contain creatures that could have pharmaceutical uses. Many of the millions of organisms in the ocean have already been found to produce chemicals that have a variety of uses, such as deterring crop predators and checking growth of weeds. Scientists believe these natural compounds could be used in medicine.

The marine environment is "incredibly diverse biologically and is enormously complex," said William Fenical, director of the Marine Research Division at the Scripps Institution of Oceanography in La Jolla, California. "But I think the ocean is 25 to 50 years behind the study of terrestrial environment. We need to turn to the marine environment for the discovery of new drugs."



Dale Nagle

Cure in Curacao? Curacin A, a substance in algae found off Curacao, may be lethal to cancer cells.

A research team in Oregon, headed by marine chemist William H. Gerwick, a professor of pharmacy at Oregon State University, is one of the leaders in the field. Gerwick is supported by the Oregon Sea Grant and is working under a five-year, $1 million grant from the National Cancer Institute. NCI is funding three discovery teams consisting of university, government, and corporate researchers exploring marine organisms as sources of new anti-cancer agents.

Gerwick's work has shown some success thus far. He discovered and received a preliminary patent for an anti-cancer compound in a tropical alga, *Lyngbya majuscula*, found off the island of Curacao near Venezuela. Studies show that the chemical, curacin A, is lethal to cancer cells in a test tube. According to Gerwick, the compound inhibits cells from dividing due to its extreme toxicity; a concentration of one part per billion is enough to kill a cell. Tests involving administration of curacin A to mice are currently being run by NCI. According to Gerwick, the drug shows some selectivity for colon and breast cancer. "It's a long pathway to becoming a clinically useful drug, but the chemical shows all the characteristics of an agent that could go the distance," Gerwick said.

Dale G. Nagle, a doctoral student on Gerwick's team, collected the algae. "You can't really tell from looking at it about what's going on," Nagle said. "This alga is growing like fine little hair out there, and nothing seems to be eating it. That gives a slight hint there's something toxic in there."

Matthew Suffness, program director of NCI's National Cooperative Natural Product Drug Discovery Group in Bethesda, Maryland, said, "The marine natural products area is becoming more and more prominent in science. We're very hopeful that we're going to get quite a number of interesting compounds out of it with potential to be developed into new agents."

Another promising anti-cancer compound that has been discovered is bryostatin 1. This chemical is produced by tiny, spongelike sea creatures called bryozoans, which are usually found in colonies attached to boat bottoms, docks, and seaweed. After preliminary tests in humans, the compound appears to be effective in treating melanoma, lymphomas, leukemias, and ovarian cancers. The chemical is "very mundane-looking and is actually a pest in our harbors," said George R. Petit, director of the Cancer Research Institute at